CLAIMS

What is claimed is:

1. A vehicle internetwork comprising a plurality of network elements including at least one node and at least one vehicle bus coupled among at least one peripheral electronic device, wherein functions of the plurality of network elements are remotely controllable, wherein the at least one node manipulates node information including configuration and security information to provide secure interoperability among the plurality of network elements and the at least one peripheral electronic device.

2. The vehicle internetwork of claim 1, wherein the at least one vehicle bus comprises at least one bus selected from a group consisting of at least one Original Equipment Manufacturer (OEM) bus, at least one Automotive Multimedia Interface Consortium (AMI-C) bus, at least one external network, and at least one local development network.

3. The vehicle internetwork of claim 2, wherein the at least one local development network accesses the at least one node for the performance of application upgrades, diagnostics, and programming.

4. The vehicle internetwork of claim 2, wherein the at least one local development network supports manipulation and transfer of entertainment software, wherein the entertainment software comprises at least one entertainment feature selected from a group consisting of video, audio, movies, television shows, music, games, and simulations.

5. The vehicle internetwork of claim 1, wherein the at least one vehicle bus comprises at least one legacy automotive bus selected from a group consisting of Audio Control Protocol (ACP) buses and Standard Corporate Protocol (SCP) buses.

6. The vehicle internetwork of claim 1, wherein the at least one peripheral electronic device comprises at least one device coupled to at least one OEM bus

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3 selected from a group consisting of climate control devices, actuator devices,

4 position location devices, Global Positioning System (GPS) devices,

5 communication devices, cellular telephony devices, processing devices,

6 diagnostic devices, modems, video devices, audio devices, multimedia devices,

7 electronic game devices, sensor devices, switch devices, and device

8 subnetworks.

1 7.   The vehicle internetwork of claim 1, wherein the at least one peripheral

2 electronic device comprises at least one device coupled to at least one AMI-C

3 bus selected from a group consisting of communication devices, position

4 location devices, GPS devices, communication devices, pager devices, cellular

5 telephony devices, processing devices, modems, video devices, audio devices,

6 multimedia devices, electronic game devices, personal digital assistants (PDAs),

7 and wireless local area network (LAN) devices.

1 8.   The vehicle internetwork of claim 1, wherein the at least one node

2 comprises at least one interface port selected from a group consisting of

3 Intelligent Data Bus (IDB-C) ports, MOST ports, Institute of Electrical and

4 Electronics Engineers (IEEE) 1394 ports, On-Board Diagnostic-II (OBD-II)

5 ports, Standard Corporate Protocol (SCP) ports, Audio Control Protocol (ACP)

6 ports, Bluetooth ports, Personal Communications Service (PCS) ports, Global

7 System for Mobile Communications (GSM) ports, and Ethernet ports.

1 9.   The vehicle internetwork of claim 1, wherein the functions are hosted on

2 a central network element, wherein the functions are distributed among the

3 plurality of network elements in response to a coupling of additional peripheral

4 electronic devices to the at least one vehicle bus.

1 10.   The vehicle internetwork of claim 1, wherein the at least one node

2 includes at least one gateway node and at least one port node, wherein the at

3 least one node provides at least one function selected from a group consisting of

4 data processing, data storage, access control, protocol translation, security

5 including service discovery and device authentication, and network control.

11. The vehicle internetwork of claim 10, wherein the at least one gateway comprises at least one interface port, at least one real-time interface processor (RTIP), and at least one application processor, wherein the at least one RTIP performs real-time operations and the at least one application processor performs high level processing functions.

12. The vehicle internetwork of claim 11, wherein the at least one gateway functions as an Internet Protocol (IP) router, wherein the at least one RTIP comprises a high-speed bus controlled by at least one coupled device.

13. The vehicle internetwork of claim 11, wherein the at least one interface port has at least one function selected from a group consisting of a tag, a bridge, and an interface.

14. The vehicle internetwork of claim 11, wherein the at least one interface port includes at least one port selected from a group consisting of wired communication ports and wireless communication ports.

15. The vehicle internetwork of claim 10, wherein the at least one gateway includes a first gateway coupled to a second gateway.

16. The vehicle internetwork of claim 10, wherein the at least one port node is coupled to at least one subnetwork.

17. The vehicle internetwork of claim 10, wherein the at least one gateway node couples a first vehicle bus and a second vehicle bus, wherein the at least one port node couples the at least one vehicle bus to the at least one peripheral electronic device.

18. The vehicle internetwork of claim 10, wherein the at least one port node comprises at least one device selected from a group consisting of at least one processor, at least one memory cache, at least one wireless modem, at least one network protocol, at least one policy, and at least one wired local area network (LAN).

1   19.   The vehicle internetwork of claim 10, wherein the at least one port node
2   comprises at least one device selected from a group consisting of at least one
3   micro real-time interface processor (RTIP), at least one appliance interface, at
4   least one communication interface, and at least one memory device.

1   20.   The vehicle internetwork of claim 19, wherein the at least one appliance
2   interface is coupled to at least one sensor, wherein the at least one
3   communication interface is coupled to at least one radio.

1   21.   The vehicle internetwork of claim 10, wherein the at least one port node
2   comprises at least one port node selected from a group consisting of a serial
3   network interface connector (SNIC) and a public network port (PNP), wherein
4   the at least one port node interacts with at least one corresponding proxy to
5   enable the at least one peripheral electronic device to operate within the
6   network.

1   22.   The vehicle internetwork of claim 1, wherein the at least one node
2   comprises at least one hybrid switch, wherein the at least one hybrid switch
3   includes at least one interface port coupled among at least one switch of a first
4   speed and at least one switch of a second speed, wherein each of the at least one
5   switch of a first speed and the at least one switch of a second speed are coupled
6   to at least one port.

1   23.   The vehicle internetwork of claim 1, wherein the at least one hybrid
2   switch distributes at least one switching function among the plurality of network
3   elements of a host vehicle.

1   24.   The vehicle internetwork of claim 22, wherein at least one application of
2   a first type is coupled through the at least one port to the at least one switch of a
3   first speed, wherein at least one application of a second type is coupled through
4   the at least one port to the at least one switch of a second speed.

6   25.   The vehicle internetwork of claim 1, wherein the at least one node
7   couples to at least one subnetwork, wherein the at least one subnetwork
8   comprises at least one device selected from a group consisting of sensor ·
9   devices, actuator devices, wired network devices, and wireless network devices.

1   26.   The vehicle internetwork of claim 1, further comprising at least one
2   router that couples to the Internet using at least one device selected from a
3   group consisting of at least one bus and at least one communication device,
4   wherein the at least one bus is selected from a group consisting of an IEEE 1394
5   bus, a MOST bus, an IDB-C bus, and an Ethernet bus, wherein the at least one
6   communication device is selected from a group consisting of a Bluetooth
7   modem, an IEEE 802.11 radio, and a mobile telephone.

1   27.   The vehicle internetwork of claim 1, wherein the at least one node
2   generates at least one hierarchy of communication alternatives in response to a
3   determined position of a host vehicle, wherein a selected communication
4   alternative is used to communicate with at least one local site.

1   28.   The vehicle internetwork of claim 1, wherein data processing is
2   controlled using at least one processing hierarchy that controls at least one event
3   selected from a group consisting of data classifications, data transfers, data
4   queuing, data combining, processing locations, and communications among the
5   plurality of network elements.

1   29.   The vehicle internetwork of claim 1, wherein the functions are
2   distributed among the plurality of network elements.

1   30.   The vehicle internetwork of claim 1, wherein the functions of the at least
2   one node include at least one function selected from a group consisting of data
3   acquisition, data processing, communication management, data routing, data
4   security, programming, node operation, protocol translation, network
5   management, and interfacing with at least one communication physical layer
6   including cellular telephony, wireline telephone, satellite telephony, packet
7   radio, microwave, optical.

1   31.   The vehicle internetwork of claim 30, wherein data processing functions

2   of at least one peripheral electronic device are distributed among at least one

3   other processor selected from a group consisting of the at least one node and the

4   at least one peripheral electronic device.

1   32.   The vehicle internetwork of claim 1, wherein the at least one node

2   implements at least one security method selected from a group consisting of

3   confounder codes, encrypted transmissions, security policy-based

4   communication protocols, blocking coupling with unauthorized devices, and

5   blocking commands from at least one class of device.

1   33.   The vehicle internetwork of claim 32, wherein the at least one security

2   method is implemented in at least one gateway node and at least one port node.

1   34.   The vehicle internetwork of claim 32, wherein the at least one security

2   method includes blocking denial of service attacks by decoupling at least one

3   port node through which unauthorized access is attempted and blocking at least

4   one application at a decoupled port node.

1   35.   The vehicle internetwork of claim 32, wherein the at least one security

2   method further includes at least one method selected from a group consisting of

3   an ignition key, a password device, and a security display.

1   36.   The vehicle internetwork of claim 32, wherein the at least one security

2   method further includes a designated authorization port, wherein at least one

3   connector is coupled to the designated authorization port to receive

4   authorization for coupling a device to the plurality of network elements.

1   37.   The vehicle internetwork of claim 1, wherein the plurality of network

2   elements automatically organize in response to the node information, wherein

3   the automatic organizing comprises automatically controlling data transfer,

4   processing, and storage among the plurality of network elements.

1 38.   The vehicle internetwork of claim 1, wherein at least one level of
2 synchronization is supported among different subsets of the plurality of network
3 elements, wherein a first level of synchronization is supported among a first
4 subset of the plurality of network elements, wherein a second level of
5 synchronization is supported among a second subset of the plurality of network
6 elements.

1 39.   The vehicle internetwork of claim 1, wherein the plurality of network
2 elements are self-assembling, wherein search and acquisition modes of the at
3 least one node search for participating ones of the plurality of network elements,
4 wherein a determination is made whether each of the participating ones of the
5 plurality of network elements are permitted to join the vehicle internetwork
6 using a message hierarchy, wherein the plurality of network elements are
7 surveyed at random intervals for new nodes and missing nodes.

1 40.   The vehicle internetwork of claim 1, wherein the plurality of network
2 elements are self-assembled into a multi-cluster network, wherein a start node is
3 selected as a base node, wherein the base node communicates an assembly
4 packet throughout the vehicle internetwork, wherein information of the
5 assembly packet alternates with each successive communication between
6 directing a node to become a base node of a particular cluster number and
7 directing a node to become a remote node of a particular cluster number,
8 wherein the particular cluster number is incrementally changed with each
9 successive communication of the assembly packet.

1 41.   The vehicle internetwork of claim 1, wherein the at least one node
2 performs service discovery, wherein service discovery comprises synchronizing
3 the at least one node, authenticating the at least one node, determining at least
4 one communication mode for the at least one node, and informing the at least
5 one node of resources available among the plurality of network elements.

1 42.   The vehicle internetwork of claim 1, wherein data is collected by the at
2 least one node, wherein at least one operation is performed on the data in

3   response to parameters established by a user, the at least one operation selected

4   from a group consisting of classification, routing, processing, storing, and

5   fusing.

1   43.   The vehicle internetwork of claim 42, wherein the data is vehicle

2   diagnostic data, wherein diagnostic operations are performed in response to the

3   data.

1   44.   The vehicle internetwork of claim 42, wherein routing comprises

2   selecting at least one communication type and at least one communication

3   coupling for use in routing the collected data.

1   45.   The vehicle internetwork of claim 42, wherein routing comprises

2   selecting at least one data type for routing, selecting at least one of the plurality

3   of network elements to which to route the selected data, selecting at least one

4   route to the selected at least one of the plurality of network elements, and

5   routing the selected at least one data type to the selected at least one of the

6   plurality of network elements.

1   46.   The vehicle internetwork of claim 42, wherein processing comprises

2   selecting at least one data type for processing, selecting at least one processing

3   type, selecting at least one of the plurality of network elements to perform the

4   selected at least one processing type, and transferring the selected at least one

5   data type to the selected at least one of the plurality of network elements using

6   at least one route through the sensor network.

1   47.   The vehicle internetwork of claim 46, wherein data processed in a

2   plurality of nodes is aggregated for further processing by other nodes.

1   48.   The vehicle internetwork of claim 46, wherein data processed by the at

2   least one node is aggregated for reporting to at least one user.

1   49.   The vehicle internetwork of claim 42, wherein storing comprises

2   selecting at least one data type for storage, selecting at least one storage type,

3   selecting at least one of the plurality of network elements to perform the

4   selected at least one storage type, and transferring the selected at least one data

5   type to the selected at least one of the plurality of network elements using at

6   least one route through the plurality of network elements.

1   50.   The vehicle internetwork of claim 42, wherein fusing comprises a first

2   node transmitting at least one query request to at least one other node, wherein

3   the first node collects data from the at least one other node in response to the at

4   least one query request, and processes the collected data.

1   51.   The vehicle internetwork of claim 1, wherein the plurality of network

2   elements comprise a plurality of application programming interfaces (APIs),

3   wherein the APIs include APIs for application support, database services,

4   routing, security, network management, and deployment.

1   52.   The vehicle internetwork of claim 51, wherein the APIs for application

2   support, database services, and routing are hosted on at least one gateway node,

3   wherein the APIs for security, network management, and deployment are shared

4   among at least one gateway node and at least one port node.

1   53.   The vehicle internetwork of claim 51, wherein the plurality of APIs are

2   layered, wherein the plurality of APIs enable distributed resource management

3   by providing network resource information among the plurality of network

4   elements, wherein information transfer among the plurality of network elements

5   is controlled using a synchronism hierarchy established in response to the

6   network resource information.

1   54.   The vehicle internetwork of claim 1, wherein the plurality of network

2   elements support atomic transaction methods.

1   55.   The vehicle internetwork of claim 1, wherein the at least one node

2   includes sensing, processing, communications, and storage devices supporting a

3   plurality of processing and protocol layers.

1 56.   The vehicle internetwork of claim 1, wherein the at least one node
2 supports at least one communication mode selected from a group consisting of
3 wireless communications, wired communications, and hybrid wired and
4 wireless communications.

1 57.   The vehicle internetwork of claim 1, wherein the at least one node is
2 coupled to the at least one remote computer using the plurality of network
3 elements, wherein the plurality of network elements includes at least one
4 element selected from a group consisting of at least one station gateway, at least
5 one server, at least one repeater, at least one interrogator, and at least one
6 network, wherein the at least one network includes wired networks, wireless
7 networks, and hybrid wired and wireless networks.

1 58.   The vehicle internetwork of claim 57, wherein the at least one network
2 comprises at least one network selected from a group comprising the Internet,
3 local area networks, wide area networks, metropolitan area networks, and
4 information service stations.

1 59.   The vehicle internetwork of claim 57, wherein the plurality of network
2 elements provides remote accessibility using World Wide Web-based tools to
3 data, code, control, and security functions, wherein data includes signals,
4 wherein code includes signal processing, decision support, and database
5 elements, and wherein control includes operation of the plurality of network
6 elements.

1 60.   The vehicle internetwork of claim 1, wherein the plurality of network
2 elements comprise a plurality of network element sets, wherein the plurality of
3 network element sets are layered.

1 61.   The vehicle internetwork of claim 1, wherein the at least one node
2 comprises a plurality of node types, wherein the plurality of node types includes
3 at least one node of a first type and at least one node of a second type, wherein a
4 first network having a first node density is assembled using the at least one node

5   of a first type, wherein a second network having a second node density is

6   assembled using the at least one node of a second type, wherein the second

7   network is overlaid onto the first network.

1   62.   The vehicle internetwork of claim 1, wherein software and data are

2   transferable among the plurality of network elements, wherein the transfer is

3   remotely controllable, wherein the software and the data are downloadable from

4   at least one location selected from a group consisting of storage devices of the

5   plurality of network elements, external storage devices, and remote storage

6   devices.

1   63.   The vehicle internetwork of claim 1, wherein the plurality of network

2   elements are managed as a distributed and active database using a distributed

3   resource management protocol, wherein the plurality of network elements are

4   reused among different applications, wherein the network elements are used in

5   multiple classes of applications.

1   64.   The vehicle internetwork of claim 1, further comprising at least one

2   database, wherein the at least one database includes at least one storage device

3   selected from a group consisting of storage devices coupled to at least one of the

4   plurality of network elements and storage devices of the at least one node.

1   65.   The vehicle internetwork of claim 1, wherein at least one coupling

2   among the at least one node and at least one external network supports data

3   transfer among the at least one node of a host vehicle, wherein the data includes

4   vehicle service data, diagnostic data, maintenance history data, security data,

5   electronic mail, and entertainment software.

1   66.   The vehicle internetwork of claim 1, wherein at least one coupling

2   among the at least one peripheral electronic device and at least one external

3   network supports data transfer among the at least one node of a host vehicle,

4   wherein the data includes vehicle service data, diagnostic data, maintenance

5   history data, security data, electronic mail, and entertainment software.

1   67.   The vehicle internetwork of claim 1, wherein the at least one node is

2   coupled to at least one diagnostic device of a host vehicle.

1   68.   The vehicle internetwork of claim 1, wherein the at least one node

2   comprises at least one diagnostic node of a host vehicle.

3   69.   The vehicle internetwork of claim 1, wherein the at least one node

4   manipulates at least one data item selected from a group consisting of vehicle

5   assembly data, vehicle maintenance data, vehicle diagnostics data, vehicle

6   position data, vehicle operations profile data, fleet management data, fleet

7   reliability analysis data, security system data, entertainment system data, and

8   targeted advertising data.

1   70.   The vehicle internetwork of claim 1, wherein at least one subset of the

2   plurality of network elements comprise at least one sensor network, wherein the

3   at least one subset further includes at least one sensor node, at least one gateway

4   station, at least one server, at least one gateway network, and at least one client

5   computer hosting a World Wide Web browser, wherein the at least one node is

6   configured as the at least one gateway station and the at least one sensor node.

1   71.   The vehicle internetwork of claim 70, wherein the at least one sensor

2   node is coupled among a monitored environment and the at least one client

3   computer, wherein functions of the at least one sensor node are remotely

4   controllable using the at least one client computer, wherein the at least one

5   sensor node provides the node information including node resource cost and

6   message priority to the plurality of network elements, wherein data processing

7   is distributed among the plurality of network elements in response to the node

8   information.

1   72.   The vehicle internetwork of claim 70, wherein at least one redundant

2   communication pathway is established among the plurality of network elements.

1 73. The vehicle internetwork of claim 70, wherein the at least one gateway
2 station performs at least one function selected from a group consisting of
3 protocol translation, sensor network management, management of transmissions
4 from a remote user, and interfacing with at least one communication physical
5 layer including wired local area networks, packet radio, microwave, optical,
6 wireline telephony, cellular telephony, and satellite telephony.

1 74. The vehicle internetwork of claim 70, wherein the at least one gateway
2 network includes wired networks, wireless networks, and hybrid wired and
3 wireless networks, wherein the at least one gateway network comprises at least
4 one network selected from a group comprising the Internet, local area networks,
5 wide area networks, metropolitan area networks, and information service
6 stations.

1 75. A vehicle internetwork comprising a plurality of network elements
2 including at least one electronic device coupled among at least one node and at
3 least one vehicle bus, wherein the plurality of network elements are remotely
4 accessible via at least one wireless Internet coupling with at least one remote
5 computer, wherein the plurality of network elements manipulate network data
6 including configuration and security data to provide secure interoperability
7 among the plurality of network elements.

1 76. A vehicle internetwork, comprising:
2 means for coupling a plurality of network elements including at least
3 one node and at least one vehicle bus among at least one peripheral electronic
4 device;
5 means for manipulating node information including configuration and
6 security information;
7 means for automatically assembling and configuring the plurality of
8 network elements in response to the node information;
9 means for remotely controlling at least one function of the plurality of
10 network elements; and

11   means for providing secure interoperability among the plurality of

12   network elements in response to the node information.